COGNITIVE NEUROSCIENCE

NEUR/PSYC 362
Spring 2015
MWF 2:00PM – 2:50PM

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COURSE DESCRIPTION
Brain science is the next frontier. How do billions of neurons and trillions of nerve connections interact to give rise to the human experience? The past few decades have seen an explosion of work on this topic. From the study of individuals with damaged brains, to recording and modulation of neural activity, scientists have started begun to untangle the mysteries of the human brain. But we are only just beginning. In this course, we will study the tools and techniques cognitive neuroscientists use to investigate how the cognitive functions of the human mind are instantiated in brain tissue. What do we know now? What are the controversies? Where will the next advances come from?

COURSE OBJECTIVES
1. Learn what has been discovered about the neural correlates of different cognitive functions
2. Learn to discuss, evaluate and analyze cognitive neuroscientific data from different methodologies.
3. Evaluate what contributions can to our understanding of the human mind by investigating the human brain.
4. Prepare students for a lifetime of making sense of new discoveries about the human brain.

MATERIALS
1. Textbook: Jamie Ward's *A Students Guide to Cognitive Neuroscience* (2010, 2nd Edition)
2. Journal/Magazine articles: For many topics, there will be required journal article assigned each week. I will post them on OWLspace. You must read the article(s) before class and come prepared to discuss.
3. OWLSpace access: I will use OWLSpace to post announcements, quizzes, journal articles, assignments, lecture slides and other course materials, as well as grades. You will be required to use OWLSpace to turn in your lab assignments. Please check this website often; you are responsible for the information on it.

COURSE REQUIREMENTS
1. Final exam
There will be a cumulative final exam (weighed approximately 50% last third of class, 25% 1st third, 25% 2nd third) given during exam period, with a mix of multiple choice, fill in the blank and short answer and based on the text, articles, and material presented during class
2. Mid-term exams
There will be two in-class, midterm exams. Each exam will be a mix of multiple choice, fill in the blank and short answer and based on the text, articles, and material presented during class.
3. Labs
There will be four labs that involve analysis of raw cognitive neuroscience data (patient lesion data, electroencephalography, functional magnetic resonance imaging) and interpretation of results. The data sets, clear set instructions for how to analyze the data, and the instructions about what has to be turned in from each lab will be posted to Owlspace several weeks prior to the due date. Your lab assigmnents must be submitted via OWLSpace by the start of the class on the day that they are due. All papers should be uploaded in Microsoft Word or pdf format, with the file name "LastName_FirstInitial_AssignmentNumber." Late papers will lose 2 points for each day they are late.
4. In class quizzes
There will be 14-15 in-class quizzes (approximately 1/week). Each quiz will have two questions, though format will vary week to week (fill-in, multiple choice, etc.). The day and time of the quiz will be unpredictable. The 10 best quizzes during the course of the semester will count towards your final grade. **There is no makeup for in class quizzes, even if you have an excused absence.**

Makeup Policy

You are expected to take all exams and turn in all assignments at the times listed in the Course Schedule. In accordance with university policy, an exception to the "no makeup" rule occurs if there is a conflict with a university sponsored extracurricular activity. If an exam or assignment due date conflicts with a university sponsored activity, you must inform me *in writing* at least one week prior to the exam or due date. Failure to attend an exam without prior notice and approval will result in a zero on that exam, except in the case of a ***documented*** medical emergency or crisis.

EXTRA CREDIT

A student may earn up to 5 points of extra credit in one of the following two methods:

1. Participate in psychology experiments. A student can sign up for participation in psychology experiments by going to http://experimetrix2.com/Rice. A copy of the department policy on the use of human subjects is available on the Psychology Department's website. Each one-hour experiment is worth 1 point of extra credit. Your experiment hours must be assigned to this class; please contact the TA if you have questions about how to do this.
2. Write a two-page reaction paper on a cognitive neuroscience-related research article published within the past five years (not assigned). **You must meet with me in advance (at least 2 weeks before the last day of class) if you wish to exercise this option;** research reports will receive a grade of "satisfactory" or "unsatisfactory." Each satisfactory report is worth 1 points of extra credit.

All extra credit must be completed (in the case of experiments) or uploaded to OWLSpace (in the case of research reports) by 5 PM on the last **day** of classes. I may also choose to offer additional extra credit opportunities throughout the semester in the form of quizzes on required readings or previous lectures. **Extra credit cannot raise your grade from an A to an A+.**

GRADING

Your grade for this class will be based on:

Cumulative final exam	30%	(60 points)
2 midterm exams	30%	(30 points each)
Four lab assignments		
Lab 1: Lesion Localization	5%	(10 points)
Lab 2: ERP analysis	10%	(20 points)
Lab 3: fMRI analysis	10%	(20 points)
Lab 4: Structure-Function	5%	(10 points)
10 Quizzes (2 questions each)	10%	(2 points each)

In total it is possible to earn 200 points, plus any extra credit points that you accumulate. To calculate your grade at the end of the semester, simply add up all the points that you've earned from tests, papers, quizzes, and extra credit and then divide by 2. Feel free to contact me at any time to discuss your grade.
Letter grades will be calculated on the following scale:

98-100%	A+	78-79%	C+
93-97%	A	73-77%	C
90-92%	A-	70-72%	C-
88-89%	B+	68-69%	D+
83-87%	B	63-67%	D
80-82%	B-	60-62%	D-
		<60%	F

HONOR POLICY

Students are expected to follow the Rice Honor System; the Honor Code applies to all exams and written assignments in this class. Your written assignments must be entirely your own work. Of course, discussing the articles and findings presented in lectures with other classmates is encouraged; however, the ideas presented in the papers that you submit should be your own. Violations of the Honor Policy will not be tolerated in this class; if you violate the Honor Policy on any assignment or exam, you will be punished according to the guidelines and procedure set forward in the Honor Code. Information regarding the Honor Code and Honor Council can be found online at http://honor.rice.edu/. Feel free to ask me to clarify anything that you do not understand. At the end of the syllabus, you will find a detailed explanation of the relevant areas of the Honor Code, as well as specific guidelines for what is permissible in this class.

AMERICANS WITH DISABILITIES ACT (ADA)

The ADA requires that all qualified persons should have equal opportunity and access to education regardless of the presence of any disabling conditions. Any student with a documented disability needing academic adjustments or accommodations should speak to me within the first two weeks of class. Students with disabilities should also contact Disability Support Services at 713-348-5841 or via their website www.dss.rice.edu.

COURSE CALENDAR

**Note: This schedule is a guide for the course and is subject to change with advance notice. Such changes will be announced on OWLSpace, and in class when possible.

Week 1: *Course overview*

Jan 12th Course overview

Jan 14th Introducing Cognitive Neuroscience

- Ward, Chapter 1

Jan 16th Neuroskepticism: Can cognitive neuroscience really teach us anything?

- Gary Marcus (November 30th, 2012). "Neuroscience Fiction". *The New Yorker*.
- Sally Satel (May 30th, 2013). "Distinguishing Brain from Mind." *The Atlantic.*

Week 2: *Overview of the brain*

Jan 21st Introducing the brain: Global Architecture

- Ward, Chapter 2

Jan 23rd Introducing the brain: Cellular signaling

- In class activity: How fast do neuronal signals travel?

Week 3: *Measuring the brain: Week 1*

Jan 26th The electrophysiological brain: Single cells and EEG

- Ward, Chapter 3

Jan 28th The electrophysiological brain: MEG and the source localization problem

- Ward, Chapter 3

Jan 30th Guest lecture (Müge Özker): ECoG: Intercranial recordings

Week 4: *Measuring the brain: Week 2*

Feb 2nd The imaged brain

- Ward, Chapter 4

Feb 4th Information vs. activation with functional neuroimaging

- Norman, K. A., Polyn, S. M., Detre, G. J., & Haxby, J. V. (2006). Beyond mind-reading: multi-voxel pattern analysis of fMRI data. *Trends in Cognitive Sciences*, *10*, 424-430.

Feb 6th In class exercise: Diffusion Tensor Imaging

- Perkel, J. M. (2013). LIFE SCIENCE TECHNOLOGIES: This Is Your Brain: Mapping the Connectome. *Science*, *339*, 350-352.

Week 5: *Measuring the brain: Week 3*

Feb 9th The lesioned brain

- Ward, Chapter 5

Feb 11th Comparing methods and Lab #1: Lesion localization

- Rorden, C., & Karnath, H. O. (2004). Using human brain lesions to infer function: a relic from a past era in the fMRI age?. *Nature Reviews Neuroscience*, *5*, 812-819.

Feb 13th Exam #1

Week 6: *Sensation and Perception*

Feb 16th The seeing brain: Lesion Data
- Ward, Chapter 6
- Goodale, M. A., Milner, A. D., Jakobson, L. S., & Carey, D. P. (1991). A neurological dissociation between perceiving objects and grasping them. *Nature*, *349*, 154-156.

Feb 18th Somatosensation: Guest lecture, Jeff Yau, BCM
- Reading TBA

Feb 20th Synaesthesia & Prosopagnosia
- Lab #2 (N170) assignment handed out and discussed

Week 7: *More perception & attention*

Feb 23rd The seeing brain: Neuroimaging Data: Guest lecture, Jim Pomerantz
- Ward, Chapter 6
- Additional Reading: TBA
- Lab #1 Due

Feb 25th Attention in the brain: Guest Lecture, TDB
- Ward, Chapter 7 (pp 128-136)
- Additional Reading: TBA

Feb 27th **NO CLASS**

SPRING BREAK

Week 8: *Space & Action*

Mar 9th The spatial brain
- Ward, Chapter 7 (rest of the chapter)
- Marshall, J. C., & Halligan, P. W. (1987). Blindsight and insight in visuo-spatial neglect. *Nature*, *336*, 766-767.
- Lab #2 Due

Mar 11th The acting brain
- Ward, Chapter 8

Mar 13th Body schema: In class demonstrations and discussions
- Graziano, M. S., & Botvinick, M. M. (2002). How the brain represents the body: insights from neurophysiology and psychology. *Common mechanisms in perception and action: Attention and performance XIX*, 136-157.

Week 9: *Reading and writing*

Mar 16th The literate brain: Lesion Data
- Ward, Chapter 12

Mar 18th The literate brain: Neuroimaging Data
- Price, C. J., & Devlin, J. T. (2011) The Interactive Account of ventral occipito-temporal contributions to reading. *Trends in Cognitive Science: 15,* 246-53.
- Dehaene, S., & Cohen, L. (2011). The unique role of the visual word form area in reading. *Trends in Cognitive Science: 15,* 254-262.

Mar 20th How to analyze fMRI data: Lab #3 handed out

Week 10: *Hearing*

Mar 23rd The hearing brain: Organization of the auditory system
- Ward, Chapter 10

Mar 25th The hearing brain: Higher order audition
- Ward, Chapter 10
- Peretz, I., & Coltheart, M. (2003). Modularity of music processing. *Nature Neuroscience*, *6*, 688-691.

Mar 27th Exam #2

Week 11: *Language production*

Mar 30th The speaking brain: Lesion Data
- Ward, Chapter 11
- Bates, E., Wilson, S. M., Saygin, A. P., Dick, F., Sereno, M. I., Knight, R. T., & Dronkers, N. F. (2003). Voxel-based lesion–symptom mapping. *Nature Neuroscience*, *6*, 448-450.

Apr 1st The speaking brain: Functional neuroimaging (Guest Lecture: Tao Wei)
- Ward, Chapter 11

Week 12: *Memory*

Apr 6th The remembering brain: Lesion Data
- Ward, Chapter 9
- Hamann, S. B., & Squire, L. R. (1997). Intact perceptual memory in the absence of conscious memory. *Behavioral neuroscience*, *111*, 850-854.

Apr 8th The remembering brain: Functional Neuroimaging
- Ward, Chapter 9
- Stark, C. E., & Okado, Y. (2003). Making memories without trying: medial temporal lobe activity associated with incidental memory formation during recognition. *The Journal of Neuroscience*, *23*, 6748-6753.

Apr 10th Lab #3 Due + Discussion of Results

Week 13: *A brief foray into other cognitive functions*

Apr 13th The numerate brain & Lab #4 Handed Out
- Ward, Chapter 13

Apr 15th The executive brain
- Ward, Chapter 14

Apr 17th The developing brain
- Ward, Chapter 16

Week 14: *Neuro-everything?*

Apr 20th Brain Computer Interfaces
- Velliste, M., Perel, S., Spalding, M. C., Whitford, A. S., & Schwartz, A. B. (2008). Cortical control of a prosthetic arm for self-feeding. *Nature*, *453*, 1098-1101.

Apr 22nd Neurolaw
- David Eagleman (July, 2011). "The Brain on Trial." *The Atlantic.*

Apr 24th Course summary & Discussion of Patients (Lab #4 Due)

Date TBD Cumulative Final Exam

ADDITIONAL INFORMATION

Submitting items to OWLspace

Lab assignments must be submitted through the Assignments section of OWLSpace. For each assignment, a link will appear; click on that link to view the assignment and upload a Microsoft Word version of your paper. All lab assignments should have file names in the following format: LastName_FirstInitial_AssignmentNumber; for example, Fischer-Baum_S_1. Once your assignment is submitted, it cannot be withdrawn. Your submission is timestamped, so be sure to submit each assignment before the time specified in the syllabus.

Honor guidelines for papers and written assignments

Citations and References

If you use information from an outside source in one of your written assignments, that source should be properly cited in APA format. For example, "Smith and Jonides (1997) claim that executive processes activate the dorsolateral prefrontal cortex." Taking information from an outside source without citing that source is considered plagiarism; this includes summarizing information presented in another source, even if you change the wording. To be safe, you should always cite. All papers with in-text citations should include a References section.

Collaboration/group work

Collaboration is not allowed on any assignment in this class. Your labs should be entirely your own work. Of course, discussing the articles and findings presented in lectures with other classmates is encouraged; however, the labs work you submit should be your own.

Study groups

Sharing class notes with other students is allowed, and you are encouraged to form study groups for the exams.